Three New Distichous-bracted Species of *Calathea* (Marantaceae) from Panama

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ABSTRACT. Three species of *Calathea* G. Mey. with distichous bracts, assigned to *Calathea* sect. *Calathea* (Marantaceae), are described as new from Panama: *C. carlae* H. Kenn., *C. chiriquensis* H. Kenn., and *C. fredgandersii* H. Kenn. All three are found in montane wet or cloud forest habitats at middle to higher elevations, 800–1400 m. *Calathea carlae* also occurs in Costa Rica, while the other two are endemic to Panama. *Calathea carlae* differs from related species by the leaf length:width ratios of 1.7–2.13:1, cream-colored bracts, claviculate bracteoles, yellow corollas, and yellow or pink-purple staminodes. *Calathea chiriquensis* is distinguished by the light green bracts, leaf length:width ratios of 1.3–1.56:1, absence of bracteoles, flowers borne singly rather than in pairs, and yellow flowers. *Calathea fredgandersii* is distinguished by the subround leaf, leaf length:width ratios of 1.15–1.55:1, a purple band along the leaf margin, a deep purple leaf sheath, verruculose petioles, white bracts, membranous bracteoles, white corollas, and white or pale pink to lilac staminodes.

RESUMEN. Tres especies de *Calathea* G. Mey. con brácteas dísticas, pertenecientes a *Calathea* sect. *Calathea* (Marantaceae), son descritas como nuevas de Panamá: *C. carlae* H. Kenn., *C. chiriquensis* H. Kenn. y *C. fredgandersii* H. Kenn. Las tres especies crecen en bosque húmedo montano o en bosque nublado a elevaciones medias a altas, 800–1400 m. Solo *C. carlae* crece además en Costa Rica, las dos otras especies son endémicas de Panamá. *Calathea carlae* se distingue de especies cercanas por las hojas con radio largo:ancho de 1.7–2.13:1, brácteas de color crema, bractéolas claviformes, corola amarilla y estaminodios amarillos o purpúreo-rosados. *Calathea chiriquensis* se distingue por las brácteas verde claras, las hojas con radio largo:ancho de 1.3–1.56:1, bractéolas ausentes, las flores solitarias, no en pares, y amarillas. *Calathea fredgandersii* se distingue por la hoja algo redondeada, las hojas con radio largo:ancho de 1.15–1.55:1, una banda purpúrea alrededor del margen de la hoja, vaina purpúrea oscura, pecíolos verruculosos, brácteas blancas, bractéolas membranáceas, corolas blancas y los estaminodios blancos o rosado pálidos a lila.

Key words: *Calathea* sect. *Calathea*, IUCN Red List, Marantaceae, Panama.

Since the publication of the Marantaceae treatment for *Flora of Panama* (Woodson & Schery, 1945), the number of species known for Panama has more than doubled. In the *Flora of Panama*, a total of 23 species were listed for the family, with 14 in the genus *Calathea*. In a paper entitled "Terrestrial Plants of Panama," Dressler (1972: 184) reported a total of 35 species for the family. In a paper describing new species from Panama, Kennedy (1976: 312) reported 49 species of Marantaceae known from Panama. Of these 49 species, 23 were in the genus *Calathea*, an increase from the original *Flora of Panama* treatment of ca. 160%. Six of these additional *Calathea* were new species from the then newly accessible El Llano–Cartí road (Panamá Province), an area which continues to be a rich source of undescribed taxa. Another rich area for Marantaceae is the region near Portobelo (Colón Province), especially the forests along the Río Guanche, where an additional five new *Calathea* species were discovered. The building of the Fortuna Dam in Chiriquí Province led to greater access for botanists to the surrounding montane wet and cloud forest habitats. Collections from this area and the adjacent provinces of Bocas del Toro and Veraguas proved critical for an understanding of the three distichous-bracted species described herein. Currently some 59 species (ca. 156% increase from the 1945 *Flora of Panama* treatment) of Marantaceae, including 16 endemic species, are known for Panama; this total includes the three new *Calathea* species described here. Of these 59 species, 43 are in *Calathea*, triple the number reported in the original *Flora of Panama* treatment, of which 13 are endemic, including two of those being described here.

The three new species described herein belong to *Calathea* sect. *Calathea*, which includes the type for the genus. In Schumann's (1902: 70) key to this group (as *Calathea* subgen. *Eucalathea*), the leads

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Table 1. Comparison of leaf and inflorescence characters among three described and three new distichous-bracted Panamanian species of *Calathea*.

Character	*C. crotalifera*	*C. brenesii*	*C. spiralis*	*C. carlae*	*C. chiriquensis*	*C. fredgandersii*
Recurved bract margin	no	no	no	yes	yes	yes
Petiole type	smooth	smooth	smooth	smooth	smooth	verruculose
Leaf length:width ratio	1.38–1.95:1	(1.53–)1.7–2.6:1	2.2–2.56:1	(1.7–)1.78–2.13:1	(1.3–)1.36–1.56:1	1.15–1.44(−1.55):1
Leaf length (cm)	30–90	(14–)18–60	36–60	43–90	(24–)29–55.5	23–41
Bract color	bright yellow to yellow-orange	cream-white, faint greenish white, or purple	white, faint greenish white, faint yellow-green	cream-white, greenish white	light green to light yellow-green	white to cream with pink tinge
Bract dimensions (cm)	2.9–3.5 × 4.2–5.4	1.6–2.7 × 1.8–3.6	1.4–1.8 × 2.4–3	2–3 × 2.8–4.4	2.8–3.7(−4.2) × (2.9–)3.5–4.4	(2–)2.2–2.7(−3.1) × (2–)2.6–3.4
Bracteoles	2(1), membranous	2, membranous	2, membranous	1, indurate claviculate	absent	2, membranous

are "Bracteae distichae" and "Inflorescentia a laterere complanata. . . ." Petersen (1890: 89) treated it as a section (as "Sect. VII. Distichae."), stressing the presence of distichous bracts, which characterizes the majority of species in this group. The new species described herein clearly exhibit these characters. *Calathea* sect. *Calathea* is characterized by the presence of several basal leaves and a single cauline leaf subtending one to several distichous, occasionally spirodistichous-bracted, complanate inflorescences; open flowers usually with callose staminode totally callose; and yellow to orange capsules with deep blue (rarely gray) seeds bearing white (rarely colored) arils (Kennedy, 1988). Furthermore, most species of this section exhibit a distinctive leaf venation pattern of seven minor veins between the raised, major veins. Of the Panamanian species, *Calathea spiralis* H. Kenn. is an unusual case. The bracts are distichous in Costa Rica and usually Panama, but in a few Panamanian populations, including the type locality, the bracts are spirally arranged. The majority of the species in other sections of *Calathea* have spirally arranged bracts. Those few that do have distichous bracts (e.g., *C. villosa* Lindl.) differ substantially in leaf and floral features and would never be confused with species in *Calathea* sect. *Calathea*. One of the most commonly collected and widespread species in this section is *C. crotalifera* S. Watson. A number of species with distichous bracts have often been confused with *C. crotalifera* because, once pressed, they are much more similar in aspect than in live material, the bract color and recurved margin character are less evident. The distichous-bracted species occurring in the higher elevations, usually above 800 m, have bracts that are white, cream, greenish white, or pale green, but not the bright yellow to yellow-orange color of *C. crotalifera*. The three new species are compared to three related Panamanian species in Table 1.

1. Calathea carlae H. Kenn., sp. nov. TYPE: Panama. Chiriquí: Fortuna Dam rd. (Oleoducto rd.), past Fortuna Dam, on rd. bank, 1133 m, 08°46′08.5″N, 82°12′33″W, 28 July 2005, *H. Kennedy & C. Black 6116* (holotype, PMA; isotypes, MO, UCR). Figure 1.

Haec species a congeneris bracteis distichis praeditis foliorum lamina ovata caulinorum proportione longitudinis cum latitudine 1.7–2.13, bracteis cremeis albidoviridibusve marginibus apicalibus recurvatis, bracteolis claviculatis, sepalis pilosis, corolla lutea atque staminodiis luteis roseopurpureisve distinguitur.

Caulescent herb, 1.7–3.5 m high, bearing 3 to 6 basal leaves and 1 cauline leaf above a stem

internode 1.2–2.2 m; stem green to light green, minutely tomentose to subhispid where exposed, subglabrous to glabrous where covered by leaf sheath; cataphylls coriaceous, narrowly ovate, apiculate, innermost cataphyll 54–73 cm. Leaf blade firm, coriaceous, ovate, apex obtuse with somewhat eccentric acumen, base rounded, shortly abruptly attenuate, 43–90 × 21–46 cm (length:width ratios [1.7–]1.78–2.13:1), 22 to 25 lateral veins per 3 cm (measured at midpoint of either side of lamina); leaf blade adaxially dull green but semi-shiny over major veins, glabrous except tomentose with minute hairs at apex, hairs 0.2–0.3 mm, midrib light yellow-green, glabrous; leaf surface abaxially light yellowish green, glabrous except minutely tomentose alongside midrib near apex, midrib yellow-green, minutely tomentose; pulvinus elliptic in cross section, deep olive-green or with tinge of purple giving a brownish cast, light yellow-green just at junction to petiole, glabrous except minutely tomentose in ca. 2 mm band along front, hairs ca. 0.2 mm, 6–14 cm in cauline leaves, 8.7–17.5 cm in basal leaves; petiole light green, subglabrous with few minute hairs just below pulvinus and above sheath, (4–)7–41 cm in cauline leaf, 75–185 cm in basal leaves; leaf sheath not auriculate, back green to light green, wings lighter, minutely tomentose at apex and along margin, hairs more dense toward base and on both wings and back in cauline leaves, 16.5–25 cm in cauline leaf, 73–118 cm in basal leaves. Inflorescences 1 to 5 per shoot, first one terminal, subsequent ones axial, imbricate, strongly complanate, rectangular, (10.5–) 12.5–22 × 4.2–5.3 cm; peduncle light green, darker just below inflorescence, minutely hispid, hairs ca. 0.3 mm, 14–36.5 cm; bracts (14 to)20 to 31, distichous, stiff, chartaceous, broadly obovate, basalmost bract depressed obovate-elliptic, conduplicate, apex retuse, sinus somewhat truncate, apical margin adjacent to sinus recurved, 2–3 × 2.8–4.4 cm; each bract subtending 6 or more flower pairs; outer surface of bracts cream-white, cream at base, tinged olive-green at junction with rachis, densely minute appressed tomentose at base, hairs more sparse toward apex, sparsely tomentose along margin; inner surface glabrous; rachis visible, deep olive-green, densely appressed tomentose, hairs tan, obscuring surface; bicarinate prophyll chartaceous, membranous at apical margins, thickened, stiff, especially at base and adjacent to carina, broadly obovate-elliptic, apex emarginate, cream-colored to tannish cream, sides and carinae appressed tomentose, center back glabrous, 1.6–2.1 × 1.1–1.6 cm, 0.6–1.1 cm wide from carina to carina; secondary bract membranous, broadly elliptic to subrectangular, apex emarginate, translucent pale cream-yellow, (1.5–)1.8–2.1 × (1.1–) 1.4–1.7 cm; bracteoles 1 per flower pair, indurate claviculate, medial, thickened apical portion light yellow, glabrous, 1.9–2.2 cm. Sepals membranous, narrowly obovate-elliptic, acute to 90°, pale cream-yellow, sparsely minutely appressed tomentose medially in apical half, glabrous basally, 26–27 × 5–6 mm; corolla tube golden, appressed pilose, 28–35 mm; corolla lobes subequal, elliptic, acute, pale yellow, sparsely minutely pilose, hairs colorless, ca. 0.1 mm, barely visible at ×14, 12–16 × 3.5–5 mm; outer staminode broadly elliptic, clawed at base, apex rounded, cupped, yellow or pink-purple, 11–13 × 9–12 mm; callose staminode obovate, apex unequally bilobed, lobes petaloid, the rest callose, yellow-orange to golden or pink-purple, 10–13 mm; cucullate staminode deep coral-colored or golden with trigger tinged pink, 6–9 × ca. 4 mm; stamen yellow or pinkish with lateral petaloid appendage; anther yellow, 2.5–3 mm; style and stigma golden, cream-colored, or pale pink; ovary white, smooth except for cluster of minute protuberances just below sepal junction with faint greenish tinge, glabrous, 2.5–3 × 1.5–2 mm. Capsule obovoid, cream-yellow, glabrous.

Distribution and phenology. *Calathea carlae* occurs at mid-elevations, from 760 to 1400 m, in premontane wet to cloud forest habitat, in moderate shade. In Panama, *C. carlae* appears to be concentrated in the Fortuna Dam region, found in both Chiriquí and Bocas del Toro provinces. This taxon is represented by a single collection from Coclé Province, but so far has not been noted for Veraguas Province, though it would be expected to occur there. Interestingly, *C. carlae* turned up in a batch of specimens received at Missouri Botanical Garden from Costa Rica in August 2010. Many of the cloud forest habitats, both in Panama and Costa Rica, are not readily accessible during the height of the rainy season, which may account for the paucity of collections. Flowering is noted as primarily during the rainy season, April to August.

IUCN Red List category. Conservation for *Calathea carlae* should be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), because it is only known from a rather small number of collections. However, its recent collection in Limón Province of Costa Rica suggests the possibility of greater distribution within the intervening areas.

Etymology. This species is named in honor of Carla Black of Volcán, Chiriquí, for her great enthusiasm for heliconias and related plants. Also,

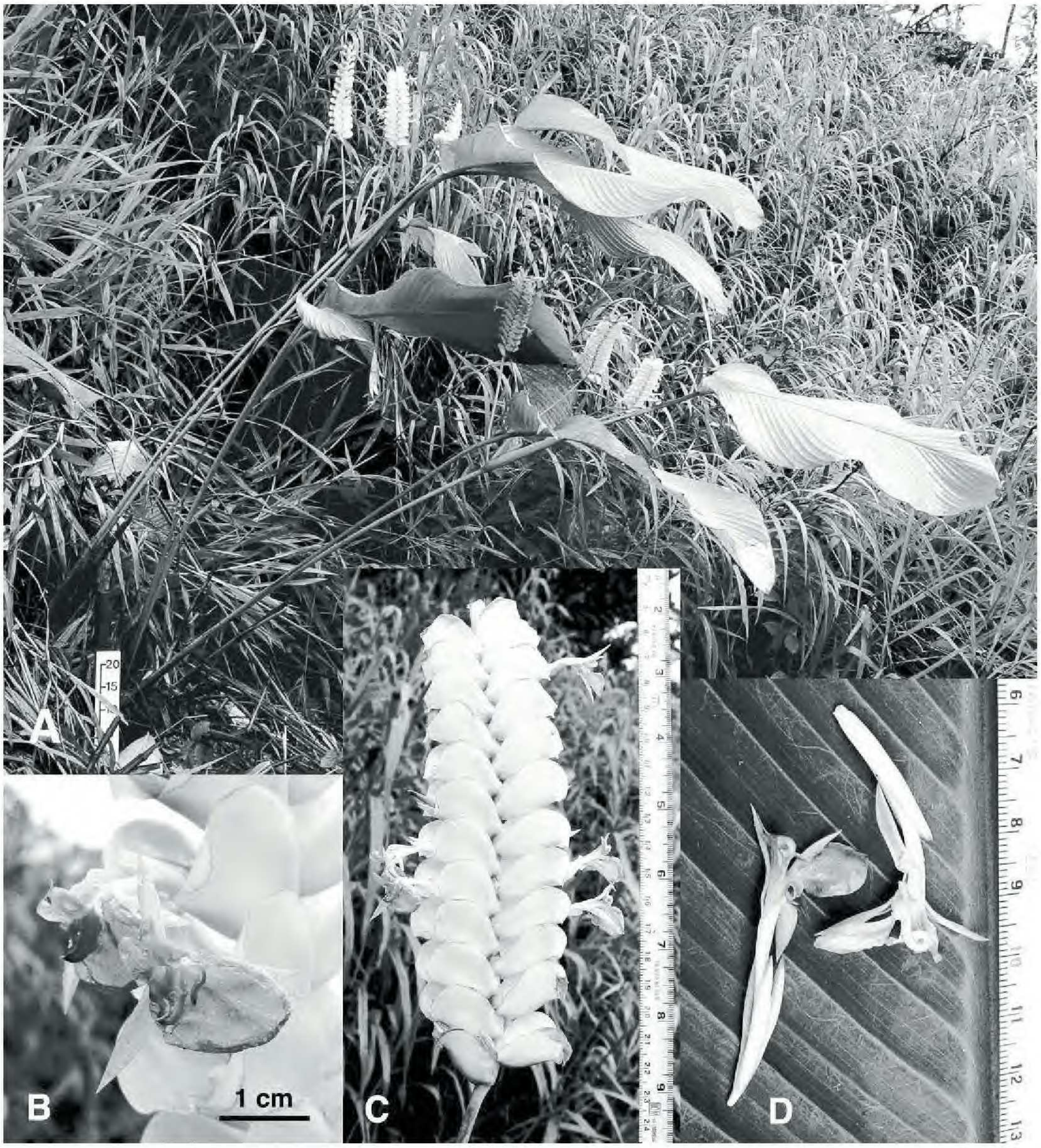

Figure 1. *Calathea carlae* H. Kenn. —A. Habit. —B. Flower, face view. —C. Inflorescence. —D. Flowers on adaxial leaf surface. Photos of the holotype, *Kennedy & Black 6116* (PMA). Photos by the author.

she is acknowledged for providing field transport in Panama, accommodations both for me and my live Marantaceae, and especially for taking me to study these three new species in the wild.

Discussion. *Calathea carlae* belongs to *Calathea* sect. *Calathea*. The new species is distinguished from other species of *Calathea* with distichous bracts by the ovate leaves with length:width ratios of (1.7–) 1.78–2.13:1 in cauline leaves, cream to whitish green bracts with recurved apical margins, claviculate bracteoles, pilose sepals, yellow corollas, and yellow or pink-purple staminodes. It differs from *C. chiriquensis* and *C. fredgandersii* by the higher leaf length:width ratios (more than 1.7:1 vs. less than 1.56:1) and the claviculate bracteoles, and additionally from *C. chiriquensis* in the cream versus green bracts and less strongly recurved bract margins. Vegetatively, *C. carlae* differs from *C. fredgandersii* in its smooth versus verruculose petioles. It differs from *C. brenesii* Standl., a Costa Rican endemic, by the sparsely tomentose, apically recurved bract margins versus densely tomentose and straight bract

margins, the claviculate versus membranous bracteoles, and the longer sepals (26–27 mm vs. 15–21 mm). Both taxa have a plain green adaxial leaf surface and cream bracts with the lowermost bract often distinctly separated from those above.

The bract color is reported as "pale yellow" (*W. G. D'Arcy et al. 15892*) or "greenish white" (*H. W. Churchill 5822A*). The corolla color is given as "yellow-white" (*W. G. D'Arcy et al. 15892*) or "flower white" (*H. W. Churchill 5822A*). In populations I have observed, including the type collection, the corolla was pale yellow and staminodes either yellow or pink-purple, polymorphic within a population. Leaves often dry grayish green versus brown, and the bracts usually retain their lighter cream color. Frequently the rachis is readily visible in live as well as dried material.

Paratypes. COSTA RICA. **Limón:** Cantón de Limón, Z. P. Río Banano, Cuenca del Banano, Valle La Estrella, Filla Matama, ca. 11 km SO del Pueblo de Aguas Zarcas, 09°48′46.8″N, 83°10′05.95″W, 24 Oct. 2007, *A. Rodriguez et al. 11471* (MO). PANAMA. **Bocas del Toro:** Fortuna Dam area, Oleoducto rd., near Cont. Divide, 08°47′N, 82°13′W, 31 July 1984, *H. W. Churchill 5822A* (MO, PMA); Fortune Dam rd. (Oleoducto rd.), past Fortuna Dam, 33.5–34 km from Los Planes, near rd. markers Km 65–66, 08°47′00″N, 82°10′52″W, 28 July 2005, *H. Kennedy & C. Black 6122* (UCR), *H. Kennedy & C. Black 6123* (PMA); Chiriquicito–Calderas Trail betw. Quebrada Higueron & Gutierrez, 08°47′N, 82°13′W, 18 Apr. 1968, *J. H. Kirkbride Jr. & J. A. Duke 762* (MO). **Chiriquí:** Fortuna Dam area, just N of reservoir, in ravine, 31 July 1984, *W. G. D'Arcy, H. W. Churchill & C. Todzia 15892* (PMA); Km 110, 16 July 1982, *J. J. Him 522* (MO). **Coclé:** Atlantic slopes, past sawmill above El Cope, 25 Aug. 1983, *W. J. Kress & B. Hammel 83-1596* (DUKE).

2. Calathea chiriquensis H. Kenn., sp. nov. TYPE: Panama. Chiriquí: vic. of Gualaca ca. 8.5 mi. from Planes de Hornito, La Fortuna on rd. to dam site, near stream, 4400 ft., 10 July 1980, *T. Antonio 5075* (holotype, PMA; isotypes, MEXU, MO, UBC). Figure 2.

Haec species a congeneris bracteis distichis praeditis lamina foliari late ovata proportione longitudinis cum latitudine 1.3–1.56, bracteis viridibus luteoviridibusve marginibus apicalibus valde recurvatis, bracteolis nullis atque floribus plerumque non geminatis luteis luteoviridibusve distinguitur.

Caulescent herb, 1.2–2 m high, bearing 2 to 6 basal leaves and 1 cauline leaf, above a stem internode 71 cm or more; stems green; cataphylls coriaceous, narrowly ovate, apiculate, innermost cataphyll ca. 21–37 cm. Leaf blade chartaceous, broadly ovate, apex obtuse to rounded with acumen, base rounded, shortly abruptly attenuate, occasionally slightly subcordate, (24–)29–55.5 × (15–)21.5–38 cm, length:width ratios (1.3–)1.36–1.56:1, 18 to 25 lateral veins per 3 cm (measured at midpoint of sides of blade); leaf blade adaxially shiny deep green, glabrous except acumen and apical margin of wider side densely appressed tomentose, hairs ca. 0.5 mm, midrib nearly concolorous, minutely tomentose in center and onto margins of midrib, hairs essentially colorless, 0.2–0.5 mm; leaf blade abaxially light green to gray-green, very minutely strigose sparsely scattered throughout but with hairs concentrated along and over the veins, barely felt, hairs ca. 0.1 mm with bulbous base, midrib tannish yellow-green, appressed tomentose, hairs faintly tan, ca. 0.2 mm, to glabrous at apex; pulvinus olive-green, occasionally tinged with purple, light green at junction with petiole, glabrous or sparsely appressed tomentose along upper side, hairs 0.2–0.4 mm, hairs more dense at junction with petiole, nearly confluent, (3.5–)4.3–8(–10) cm; petiole green, surface minutely reticulated and slightly rough to touch just below pulvinus, smooth below, glabrous, (17.5–)23.5–43(–57) cm in cauline leaves, up to 105 cm in basal leaves; leaf sheath not auriculate, green, or tinged purple apically, appressed tomentose at very base and onto adjacent stem, hairs sparse or subglabrous apically, margin minutely tomentose, 16–31.5 cm in cauline leaf, 23–48 cm in basal leaves. Inflorescences 1 to 4 per shoot, first one terminal, subsequent ones axial, imbricate, strongly complanate, rectangular, 11–18(–20) × (3–)4–6.5 cm; peduncle green, densely appressed tomentose in uppermost 0.5 cm, hairs sparser basally to subglabrous by 4 cm or more, 16.5–36(–45) cm; bracts 13 to 26, softly pliable, distichous, overlapping at base in live material, rachis usually not visible, transverse broadly elliptic, conduplicate, apex retuse, apical 1/3–1/2 of margin recurved, 2.8–3.7(–4.2) × (2.9–)3.5–4.4 cm, the basalmost bract often separated (to 4.3 cm) from upper ones and larger; each bract subtending 5 to 7 unpaired flowers; outer surface of bracts light green to yellow-green, sparse, very minutely hispid in marginal 1/3–1/2, hairs along outermost 1 mm of basal margin to 0.2 mm, hairs sparse or glabrous apically; inner surface shiny, glabrous; bicarinate prophyll thickened, callose at base and along carina, sides membranous, ovate-elliptic, apex obtuse or with slight acumen, translucent pale yellow to chartreuse, sides minutely tomentose, sparse in basal half except at very base hairs dense and longer, center back glabrous, 2.1–2.5 × 1–1.2 cm, 0.7–0.8 cm wide from carina to carina; secondary bract membranous, elliptic, apex rounded, translucent pale yellow to chartreuse, sparsely minutely strigose in apical 1/3,

Figure 2. *Calathea chiriquensis* H. Kenn. —A. Habit. —B. Inflorescence. —C. Flowers on leaf. —D. Flower, face view. —E. Seeds and capsules on leaf. Photos of *Kennedy & Black 6115* (UCR). Photos by the author.

glabrous basally, 1.9–2.2 × 1.1–1.4 cm; bracteoles apparently absent. Flowers usually unpaired; sepals membranous, narrowly obovate, acute to 90°, translucent white basally, upper 1/3–1/2 pale yellow, apical 1/3 minutely appressed pilose, subglabrous basally except pilose at very base, 21–26 × 5–5.5 mm; corolla tube light yellow, appressed pilose, hairs 0.4–0.8 mm, 22–25 mm; corolla lobes subequal,

elliptic, obtuse to 90°, incurved, appearing acute, yellow with apex yellow-orange to cream-colored, minutely pilose, hairs ca. 0.1–0.2 mm, 12–16 × 3–4.5 mm; outer staminode obovate, rounded, bright yellow, 10–14 × 8–12 mm; callose staminode callose except petaloid at apical margin, elliptic, apex bilobed, apical margin recurved, yellow-orange, 12–15 mm; cucullate staminode yellow, thickened central portion coral-colored, 7–8.5 × ca. 4 mm; filament coral-colored with lateral, yellow-orange, petaloid appendage, ca. 1.5 mm wide; anther white, ca. 3 mm; style and stigma orange; ovary smooth, pale yellow, glabrous except pilose right at junction to sepals, 2–2.5 × ca. 1.5 mm. Capsule obovoid, pale yellow, pilose at junction to sepals, glabrous below, ca. 11–12 mm high, crowned by a persistent, pale yellow calyx; seeds trigonous, rugose on outer surface, blue, 6.5–7.5 × 4–4.5 × 3–3.5 mm, bearing a white aril, ca. 3 mm long.

Distribution and phenology. *Calathea chiriquensis* is endemic to Panama with a more restricted distribution than the other two species described here. It is currently known only from Chiriquí and Bocas del Toro provinces in the general region of the Fortuna Dam. *Calathea chiriquensis* occurs at mid-elevations, 800–1400 m, in premontane wet to cloud forest habitat, in the forest understory. Flowering is noted from February to September (November).

IUCN Red List category. Conservation for *Calathea chiriquensis* should be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), because it is only known from a rather small number of collections.

Etymology. As this species is primarily found in Chiriquí Province, the specific epithet *chiriquensis* seemed fitting.

Discussion. *Calathea chiriquensis* belongs to *Calathea* sect. *Calathea*. The new species is distinguished from other species of *Calathea* with distichous bracts by the broadly ovate leaf blades, length:width ratios of (1.3–)1.36–1.56:1, the green to yellow-green bracts with strongly recurved apical margins, the absence of bracteoles, the flowers usually unpaired, and the yellow to greenish yellow flowers. Leaf blades, petiole, and sheaths of the new taxon usually dry fairly uniform brown and, unlike *C. fredgandersii*, do not show a blackish leaf sheath or a purple band on the leaf blade abaxial surface. The leaf sheath and petiole are essentially smooth to the touch, whereas they are distinctly roughened verruculose in *C. fredgandersii*. In most pressed specimens, the recurved margins end up folded back, and this recurved character is quite evident. *Calathea chiriquensis* most closely resembles *Calathea* sp. A. (Kennedy, 2003: 654) from Costa Rica. Both taxa share a similar bract color with a strongly reflexed bract margin and yellow flowers, but differ as to bracteoles and flower pairs. Besides the absence of bracteoles, an even more unusual floral feature of this species was that the flowers were borne singly rather than in pairs. This striking anomaly was discovered when dissecting pickled material sent from Chiriquí, unfortunately after the loan material had been returned. A few unmounted specimens, all from Chiriquí, were examined and all showed the unpaired flower character. This is quite unusual and possibly just a freak occurrence as the population size examined is so small. So far, this has only been recorded in the greatly reduced basal inflorescences, bearing cleistogamous flowers, in *C. micans* (L. Mathieu) Körn. and *C. fucata* H. Kenn. (Kennedy, 1988: 131–135). Unpaired flowers are characteristic of the Neotropical genus *Monotagma* K. Schum.

The bract color is reported on labels as green or greenish yellow and flower color as pale yellow, yellow-orange, yellowish green, whitish green, cream, or white. However, *W. J. Kress & S. Knapp 82-1354* note "Bracts bright green, flowers yellow and pink." It may be that this species also exhibits the color polymorphism of yellow or pink-purple flowers as found in *Calathea carlae* and *Calathea* sp. A, mentioned above.

Paratypes. PANAMA. **Bocas del Toro–Chiriquí:** along the divide, 23 June 1986, *W. J. Kress, H. Luther, L. Besse & J. Halton 86-1981* (MO, SEL). **Bocas del Toro:** de la cabaña del Sr. Lino subiendo el filo al SE de la cabaña, 23 Nov. 1990, *J. Aranda B., B. Cuevas, J. Araúz, E. Ponce & F. Arosemena 1618* (PMA); Fortuna Dam area, Oleoducto rd., near Cont. Divide, 08°48′N, 82°12′W, 5 Feb. 1984, *H. W. Churchill, G. de Nevers & H. Stockwell 4485* (MO); along rd. betw. Fortuna Dam & Chiriquí Grande, along gravel rd. which departs main hwy. near Cont. Divide (4.5 mi. N of bridge over Fortuna Lake), just S of border with Bocas del Toro Prov., 08°44′N, 82°17′W, 22 June 1987, *T. B. Croat 66634* (MO); Pipeline Rd. 2 km from Fortuna Hwy., trail below Cont. Divide, 25 June 1986, *W. J. Kress, H. Luther, L. Besse & J. Halton 86-2024* (MO, SEL). **Chiriquí:** Rd. to Fortuna Dam site N of Gualaca, 22.7 mi. beyond Río Estí bridge, 22 Nov. 1979, *T. Antonio 2794* (MO); vic. of Gualaca ca. 8.5 mi. from Planes de Hornito, La Fortuna on rd. to dam site, near stream, 10 July 1980, *T. Antonio 4148* (MO); Valle de la Sierpe, SE a lo largo de Quebrada Bonita, *M. D. Correa A. 5119* (MO, PMA); along rd. from Gualaca to Fortuna Dam site, 5.9 mi. NW of Los Planes de Hornito, 08°43′N, 82°17′W, 9 Apr. 1980, *T. B. Croat 49877* (MO); along rd. betw. Gualaca & Fortuna Dam site, 8.3 mi. NW of Los Planes de Hornito, 08°44′N, 82°16′W, 9 Apr. 1980, *T. B. Croat 49952* (MO); along hwy. betw. Gualaca & Chiriquí Grande, 1 km S of Cont. Divide & Bocas del Toro boundary, 08°45′N, 82°18′W, 26 June 1987, *T. B. Croat 66855* (MO); Gualaca–Chiriquí Grande, 7.2 mi. beyond Planes de

Hornito, 19 Sep. 1987, *T. B. Croat 67819* (MO); Fortuna Dam Area, Fortuna–Chiriquí Grande, 1.8 mi. NW of center of dam, 08°45′N, 82°18′W, 27 June 1994, *T. B. Croat & G. Zhu 76498A* (MO); Fortuna Dam region, Camp Hornito, camp to Landau to Pitti to camp, 08°44′N, 82°10′W, 27 Sep. 1976, *R. L. Dressler 5502* (PMA, UCR); La Fortuna Hydroelectric Project, near camp, 19 Mar. 1978, *B. Hammel 1996* (MO); La Fortuna area, ca. 7 mi. N of Los Planes de Hornito, along small draw, 26 Aug. 1985, *B. Hammel & W. J. Kress 13476* (DUKE); 1 km N of Fortuna Lake, 08°45′N, 82°13′W, 10 Mar. 1983, *R. J. Hampshire & C. Whitefoord 405* (BM, MEXU, MO); Fortuna Dam rd. (Oleoducto rd.), 12.5–13 km from Los Planes, just S of Smithsonian Field Station, 08°43′04″N, 82°14′06″W, 31 July 2005, *H. Kennedy & C. Black 6115* (UCR); IRHE Fortuna Hydroelectric Project, N of Carr. del Oleoducto, Quebrada de Arena, 08°46′N, 82°12′W, 12 Mar. 1982, *S. Knapp, W. J. Kress & B. Hammel 4080* (MO); La Fortuna Dam project, slopes above Quebrada de Arena, 12 Mar. 1982, *W. J. Kress & S. Knapp 82-1354* (DUKE, PMA); slope NW of confluence of Río Hornito & Río Chiriquí, ca. 08°44′N, 82°13′W, 11 Nov. 1980, *W. D. Stevens 18344* (MO, UBC); Distr. Boquete, Fortuna Dam site, 6 Feb. 1984, *H. van der Werff & C. van Hardeveld 6582* (MO, UBC).

3. Calathea fredgandersii H. Kenn., sp. nov. TYPE: Panama. Veraguas: vic. of Escuela Agricultura Alto Piedra, near Santa Fé, along trail to top of Cerro Tute, near stream, 3500 ft., 29 July 1980, *T. Antonio 4954* (holotype, PMA 30230; isotypes, MO 5304353, UBC 192832). Figure 3.

Haec species a congeneris bracteis distichis praeditis petiolo verruculoso, lamina foliari late ovata vel subrotunda proportione longitudinis cum latitudine 1.15–1.55, inflorescentia saepissime solitaria, bracteis albis cremeisve, bracteolis membranaceis atque floribus albis lavandulisve distinguitur.

Caulescent herb, 0.75–2 m high, bearing (0)2 to 5 basal leaves and 1 cauline leaf above a stem internode 54–86 cm or more; cataphylls stiff, chartaceous, narrowly ovate, apiculate, dark purple, minutely tomentose to subhispid, veins prominent, surface finely ridged when dry, innermost cataphyll ca. 26 cm long; stem green, verruculose and strigose apically. Leaf blade stiff, chartaceous, subround, broadly elliptic to broadly ovate, length:width ratios of 1.15–1.44(–1.55):1, apex obtuse to rounded with pronounced slightly eccentric acumen, base rounded to truncate, occasionally shortly abruptly attenuate, 23–41 × 18–31.5 cm in cauline leaves, 36–58 × 24–35 cm in basal leaves; vein spacing (measured at midpoint of lamina) 16 to 24 veins per 3 cm; leaf blade adaxially deep green, glabrous except acumen and adjacent apical margins densely appressed tomentose, midrib deep green, appressed tomentose, hairs to 1 mm, golden brown; leaf surface abaxially pale gray-green with purple-tinged band to 3 cm wide along margin of narrower side (portion of blade rolled to the outside), glabrous, midrib olive-green, appressed tomentose, hairs golden brown, glabrous in apicalmost 2 cm; pulvinus elliptic in cross section, olive-green, glabrous, occasionally with very sparse hairs ca. 0.1 mm, articulate, thinner than petiole, 3–7.5(–9) cm; petiole brownish olive-green, appearing honeycombed, aveolate, markedly verruculose, scabrid, 3–31(–40) cm in cauline leaf, 34.5–73 cm in basal leaves; leaf sheath not auriculate, central back portion green, wings tinged purple, very margin appressed tomentose, hairs shorter, strigose toward back, center back portion reticulate, verruculose apically, with small warts bearing hairs toward base, hairs at base to 1 mm, wings ridged, more pronounced when dried, hairs on minute protuberances between veins, 13.5–21.5 cm in cauline leaf, 45–59 cm in basal leaves. Inflorescences 1, rarely 2, per shoot, terminal, imbricate, strongly complanate, rectangular, usually borne above the level of the leaves, 8–16 × (2.9–)3.5–4.5 cm; peduncle green, tinged brownish just below inflorescence, slightly verruculose, apical 0.3–0.5 cm densely appressed tomentose, hairs golden brown ca. 0.5 mm, the basal portion covered with minute papillae each bearing a hair 0.5–0.7 mm, hairs sparser toward the base, 25–60(–70) cm long; bracts (13 to)16 to 21, distichous, stiff, chartaceous, basalmost bract broadly transverse elliptic, upper bracts broadly transverse obovate, conduplicate, retuse, sinus truncate, rather than rounded, apical margins recurved, (2–)2.2–2.7(–3.1) × (2–)2.6–3.4 cm; each bract subtending 5 or more flower pairs; rachis green to dark olive-green, sparsely tomentose; outer surface of bracts white to cream, sometimes with faint pinkish tinge in young bracts, very base of bract usually olive-green, especially in basalmost bract, subglabrous, sparse very minute hairs < 0.1 mm (×27 magnification) barely felt, slightly more dense along midline or hairs restricted to edge of apical margin (*Hammel 3563*); inner surface glabrous; bicarinate prophyll membranous, elliptic to subrectangular, apex broadly obtuse to rounded, occasionally with short acumen, appressed pilose along margins near apex and on carina in apical 1/4–1/3, the rest glabrous, 1.8–2 × 0.9–1.2 cm, 0.5–0.7 cm wide from carina to carina; secondary bract membranous, ovate-elliptic, apex rounded, glabrous or minutely pilose along apical margin, glabrous basally, 1.7–1.9 × 1–1.2 cm; bracteoles 2 per flower pair, medial, membranous, 1-channeled, 1-carinate, narrowly elliptic, glabrous, 1.5–1.8 × 0.3–0.45 cm. Sepals thin, herbaceous, narrowly elliptic, acute to 90°, margins incurved, white, glabrous, occasionally 3 or 4 hairs (at ×27 magnification) at apex, 15–21 × 4–5 mm; corolla white, tube

Figure 3. *Calathea fredgandersii* H. Kenn. —A. Leaf and inflorescence. —B. Flower, face view. —C. Base of pulvinus and upper portion of verruculose petiole. Photo A, property of SCZ herbarium, photographed by Carmen Galdames (*Galdames et al. 5507*, SCZ), used with permission of Mireya Correa, curator. Photo B by Bruce Dunstan, near Fortuna, Chiriquí Province. Photo C by Carla Black, *Kennedy & Black 6126* (UCR).

densely minutely appressed pilose, 12–16 mm long, shorter than sepals; corolla lobes white, subequal, elliptic, narrowly obtuse, inrolled appearing acute in live material, appressed pilose, hairs ca. 0.2 mm, 9.5–13 × 3.5–5 mm; staminodes white, pale pink, or purplish pink, callose staminode somewhat deeper colored than others; outer staminode obovate, cupped apically, apex rounded, 7–8.5 × 5–7.5 mm; callose staminode almost totally callose, only apical 1–2 mm of acumen petaloid, obovate-rectangular, apex acuminate, occasionally very shortly bilobed, 8–10.5 mm; cucullate staminode 5–7 × 3.5–4.5 mm; stamen white or pale pink with lateral petaloid appendage; anther white or pink, ca. 2 mm; style and stigma pinkish white to deep pink; ovary smooth, white, glabrous, ca. 2.5 mm. Capsule obovoid, cream-colored, glabrous, crowned by a persistent calyx; seeds usually 3 per capsule, trigonous, rugose on outer surface, blue, 5.5–7 × 4–4.5 × 3.5–4 mm, bearing a fibrous white aril to 4 mm.

Distribution and phenology. *Calathea fredgandersii* occurs at mid-elevations, 800–1350 m, in premontane wet to cloud forest habitat, in relatively dense shade often near streams. *Calathea fredgandersii*, like *C. chiriquensis* and *C. carlae*, occurs in the general region of Fortuna Dam in Chiriquí Province, but appears to be most abundant in Veraguas Province, where neither of the other two species have been recorded. *Calathea fredgandersii* and the sympatric *C. carlae* are each known from a single collection in Coclé Province. Flowering is noted as mainly from (December to)February to July and fruiting from April through September(to October).

IUCN Red List category. Conservation for *Calathea fredgandersii* should be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), because it is known from few populations in a relatively restricted area, though it is relatively abundant in Veraguas Province. The difficulty of collecting in these montane wet habitats,

while reducing the threat, also limits our knowledge of these species.

Etymology. This species is named in honor of Fred R. Ganders, former director of the UBC Herbarium, in gratitude for his funding of my Marantaceae fieldwork and herbarium studies and for botanical and oenological consultation.

Discussion. *Calathea fredgandersii* belongs to *Calathea* sect. *Calathea*. The new species is distinguished from other species of *Calathea* with distichous bracts by its broadly ovate, subrotund (length:width ratios of 1.15–1.44[–1.55]:1) leaf blades, the verruculose petioles, the single inflorescence of white to cream bracts, the membranous bracteoles, and white or lavender flowers. In dried specimens the dark brownish to blackish purple leaf sheath and the broad purple band along the narrower side (half rolled to outside in young, unopened leaves) of the blade are very distinctive of this species. The wings of the sheath are very dark throughout, but the back portion is lighter near the apex, although the basal third to half of the leaf sheath is dark all around. The sympatric *C. chiriquensis*, when dry, has medium brown leaf sheaths with the wings (sides) the same color as the back (occasionally lighter), the underside of the leaf is uniform in color, lacking a darker marginal band, and has virtually smooth petioles. *Calathea chiriquensis* is readily distinguished in the field by the smooth versus verruculose petioles, green versus white bracts, and the usually two or more inflorescences. The citation of *C. brenesii* as occurring in Panama (D'Arcy, 1987; Correa et al., 2004) was due to my tentative identification of dried specimens of *C. fredgandersii*, as such. *Calathea fredgandersii* and *C. brenesii* share membranous bracteoles, a similar bract color, the distinctive separation of the lowermost bract from the upper ones, and the rachis (usually) evident in dried material. However, the verruculose petiole and very dark leaf sheath of *C. fredgandersii* readily distinguish the two. Most similar in general morphology is *Calathea* sp. B (Kennedy, 2003: 654) from Costa Rica. Both share the subround leaves, distinctively verruculose petioles, usually single inflorescence, and recurved bract margins. *Calathea fredgandersii* is readily distinguished from *Calathea* sp. B by the white versus chartreuse bracts and membranous versus claviculate bracteoles.

The bract color is usually reported on labels as white, but ivory, yellow-white, and greenish cream have been mentioned. Flower color is polymorphic. The staminodes are either white, like the corolla, or pale pink to pinkish purple.

Paratypes. PANAMA. **Bocas del Toro–Chiriquí:** along the divide, 23 June 1986, *W. J. Kress, H. Luther, L. Besse & J. Halton 86-1985* (MO, SEL); above Fortuna Dam, ca. 08°45′N, 82°15′W, 3 Dec. 1985, *G. McPherson 7712* (MO). **Chiriquí:** Fortuna Dam area, North Quebrada de Arena, along river, 08°46′N, 82°12′W, 7 Feb. 1984, *H. W. Churchill, G. de Nevers & H. Stockwell 4711* (MO); rd. from Fortuna Lake to Chiriquí Grande, trail W of Cont. Divide, 08°47′N, 82°13′W, 22 Mar. 1985, *R. J. Hampshire & C. Whitefoord 866* (BM); ca. 1 km from main, Fortuna Dam rd. (Oleoducto rd.), Sendero Los Tucanes, ca. 0.5 km in along trail, start of trail at 8°47′07″N, 82°12′51″W, 31 July 2005, *H. Kennedy & C. Black 6126* (MEXU, PMA, UCR); windswept ridge 8 km N of Los Planes de Hornito, IRHE Fortuna Hydroelectric Proj., 08°45′N, 82°12′W, 9 May 1982, *S. Knapp 5005* (MO); windswept ridge 10 km N of Los Planes de Hornito, IRHE Fortuna Hydroelectric Proj., 18 June 1982, *S. Knapp & Vodicka 5608* (MO); La Fortuna Dam site, 8 mi. from Planes de Hornito, 13 Mar. 1982, *W. J. Kress, B. Hammel & S. Knapp 82-1352* (DUKE, PMA), *82-1357* (DUKE, PMA); Reserva La Fortuna, Divide Trail, 11 May 1991, *B. M. O'Connor 91-0511-013* (MICH, MO). **Coclé:** Pacific drainage, on ridge W of Sawmill above El Copé, 21 June 1978, *B. Hammel 3563* (MO). **Veraguas:** Cerro Tute, ca. 5 km W of Santa Fé, along path, 14 May 1981, *L. Andersson & K. J. Sytsma 1281* (MO, NY); Distr. de Santa Fé, Serrania de Tute, de Mirador hasta la encima, 08°33′N, 81°07′W, 5 July 1996, *J. Aranda, C. Galdames, B. Araúz & S. González 2656* (SCZ); Cerro Tute, NW of Santa Fé, 10–11 Oct. 1976, *R. L. Dressler 5528* (MO, PMA); "Cerro Tute," ridge up from former Escuela Agrícola, Santa Fé, 08°35′N, 81°05′W, 20 Feb. 1983, *C. Hamilton & R. L. Dressler 3047* (MO), *3079* (MO); "Cerro Tute," ridge up from former Escuela Agrícola, Santa Fé, 08°35′N, 81°05′W, 15 July 1983, *C. Hamilton & K. Krager 3984* (MO), *3996* (MO); mtns. W of Alto de Piedras, W of Santa Fé, 8 Sep. 1978, *B. Hammel 4630* (MO); ridge of Cordillera de Tute, trail to Cerro Tute, above Escuela Agrícola Alto de Piedra, just W of Santa Fé, 08°32′N, 81°07′W, 5 June 1982, *S. Knapp & R. L. Dressler 5420* (MO, PMA); Cerro Arizona, above Santa Fé, 27 Apr. 1980, *W. J. Kress 80-1185* (MO); Cerro Tute, along ridge trail toward summit, 08°30′N, 81°07′W, 21 Mar. 1987, *G. McPherson 10738* (MO).

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